SPOTTED OWL AND BARRED OWL RESOURCE SELECTION IN SOUTHWESTERN WASHINGTON
PROGRESS REPORT FEBRUARY 2010

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INTRODUCTION

A scattered collection of Northern Spotted Owls (*Strix occidentalis caurina*) may persist in Southwestern Washington (SWWA), which primarily includes second-growth forests and young plantations. Apparent persistence in such an intensively managed landscape has spawned a perspective that the area might serve as a future dispersal link between Spotted Owl sub-populations in the Washington Cascades with those on the Olympic Peninsula. Such a possibility would hinge upon first understanding how the few Spotted Owls living in the area respond to existing forest conditions before evaluating how dispersing owls might traverse it. Thus, the Washington Department of Natural Resources (WADNR) and Weyerhaeuser Company contracted NCASI to conduct a habitat-selection study, the results of which might suggest innovative forest management practices that may support conservation of Northern Spotted Owls in SWWA.

Effective conservation also requires understanding the potential for forest management to influence presumed competitive interactions between Spotted Owls and northern Barred Owls (*Strix varia*) in the context of intensively managed, second-growth forest landscapes. The study began in spring 2007; here, we primarily describe progress made since February 2009 on a baseline effort that aims to characterize home ranges, home range overlap, and habitat selection by Spotted Owls and associated Barred Owls in Southwestern Washington. So far as we can determine, the study area currently contains no Spotted Owls; thus, recent activities feature Barred Owls. The study was recently extended through August or September 2010 to acquire additional information on Barred Owl food habits and roosting locations.

STUDY AREA

The study area lies in the Coast Ranges Physiographic Province in SWWA and includes forests administered by the WADNR and timberlands owned by private industrial companies, primarily Weyerhaeuser Company. Forests in SWWA are comprised predominantly of recent clearcuts, young plantations and 25-80 year-old second-growth stands, with scattered patches of somewhat older stands. The area chosen for this project, a radio-telemetry study, lies west of Chehalis and south of U.S. Highway 12. Initially, there were 3-4 locations that were assumed to contain Spotted Owls: Blue Mountain, Pioneer Creek, Elk Creek, and Seven Creek, based upon previous survey information.

GOALS

We wanted to examine responses by Spotted Owls and Barred Owls to variation in forest conditions including tree density, tree species composition, snags, downed coarse woody debris, understory vegetation, tree size-class distribution, and the physical environment in an intensively managed forest landscape. Specifically, we wish to estimate resource selection functions (RSF) for each species using extant data from forest inventories and measures of physical environmental factors in areas used at night by radio-tagged birds. Foraging choices and other nocturnal behaviors such as territory- and social maintenance are generally believed to influence lifetime reproductive performance and survival among territorial birds. We will therefore retrospectively identify the combinations of vegetative and physical environmental factors that influence habitat selection during nocturnal behavioral activities (hereafter labeled as foraging habitat) for each species in this intensively managed landscape. The project study plan describes details about RSF models and methods, and the 2008 annual report described observations made during surveys and distributions of initial telemetry points. After the first year of study, a new Barred Owl objective was added, with 2 parts: a) acquire daytime telemetry locations of Barred Owls to provide roost-site information, from which we will estimate a separate resource selection function; and b) gather regurgitated pellets to describe Barred Owl food habits during the nesting season. Here, we report home range sizes, home range overlap, maps of distributions of telemetry recordings, as well as preliminary findings on food habits of Barred Owls.

Specific objectives include the following:

1. Capture and radio-tag each member of 8-10 pairs of Barred Owls and all Spotted Owls encountered at 3-4 locations where Spotted Owls were identified in 2005 and 2006 surveys or otherwise may exist.
2. Measure details of habitat conditions in home ranges of each species, based upon agency and company inventories.
3. Using data from Objectives 1 and 2, develop a discrete-choice resource selection function for each species, compare model variables and their coefficients.
4. Prepare a GIS-based habitat-capability map for Spotted Owls and Barred Owls.
5. Compare fixed-kernel home range sizes of Spotted Owls and Barred Owls occupying the same area.
6. Evaluate roost-site selection and nesting season food habits of Barred Owls.

TELEMETRY ACTIVITIES

Telemetry Database--. We began capturing and radio-tracking owls in May 2007. Data contained in this report represent telemetry points acquired from May 2007 through late January 2010. Using GPS equipment, we geo-referenced and flagged telemetry-receiving stations at approximately 400-m intervals along forest access roads. These provided the basis for accurate telemetry triangulation. In 2007, we captured and radio-tagged 6 Barred Owls in May and June, and captured and radio-tagged 2 Spotted Owls in July of that year. We captured 5 additional Barred Owls in spring and summer of 2008, and 7 in 2009 and early 2010, for a total of 18 over the course of the study, including both members of 4 pairs. Of the two Spotted Owls captured and radio-tagged in 2007, one was a female (Pioneer Creek) and the other was a male, at Elk Creek. Of the 18 radio-tagged Barred Owls, 5 have been found dead. Their deaths apparently were caused by predators, which we speculate were Great-Horned Owls or Red-tailed Hawks, both of which were in the area. As of the date of this report, we are currently tracking 11 Barred Owls (2 others carry transmitters with defunct batteries). As of 26 January 2010, we have recorded 2,878 telemetry points for the 20 owls (Table 1), including 881 daytime roosting locations and 1,997 nocturnal (foraging) locations.

Areas Traversed--. In Figures 1 and 2 we show the telemetry locations and cumulative areas used, or traversed, as estimated by a 95% MCP home ranges algorithm for each bird. We do not subscribe to or promote the MCP as a reliable method for characterizing home range size,

but rather use it to estimate "availability" of resources within areas traversed. Both Spotted Owls vacated their territories and subsequently were found dead. The Pioneer Creek female Spotted Owl left her home range, traveled 15 miles (straight-line distance) across the Chehalis River Valley, and occupied a large area within the Capitol State Forest (Figure 1). The male Spotted Owl from Elk Creek moved some 6 miles to Seven Creek (Figure 2). While we cannot discount the possibility that those moves, unusual for adult owls, may have been precipitated by dual use of prey species, we believe the moves were most likely a result of frequent direct encounters with Barred Owls. For example, the Pioneer Spotted Owl's regulatory circle overlapped territories of 5 Barred Owl pairs, and the Elk Creek Spotted Owl's regulatory circle encompassed territories of at least 3 pairs of Barred Owls. One of those (Fall River) overlapped nearly all of the telemetry points of the Elk Creek Spotted Owl. We also observed Barred Owls aggressively responding to our voiced Spotted Owl calls, particularly at the Elk Creek Spotted Owl site.

Other information supports a view that the Spotted Owl movements may have resulted from direct encounters with Barred Owls. The Elk Creek male Spotted Owl moved out of its territory in November 2007, and traveled approximately 6 miles to Seven Creek, which had been occupied by Spotted Owls in the past; that is, it was a "known" Spotted Owl site. The Seven Creek area was occupied by at least 1 pair of Barred Owls, one of which (the male) was radio-tagged. We triangulated the Elk Creek male Spotted Owl in close proximity to the radio-tagged Seven Creek male Barred Owl on several occasions. While we cannot be certain, the data suggested a possible antagonistic interaction during which the Seven Creek Barred Owl and the Elk Creek Spotted Owl both made a rapid 6-mile movement from Seven Creek and were found very close together at Elk Creek on Jan 10, 2008. The sudden move occurred a month after the severe storm event in December 2007. After the storm, road access was highly restricted for a few weeks, so we do not know behaviors that preceded the move. Both birds returned to Seven Creek on 2 February 2008, and the Elk Creek male Spotted Owl remained in that general area until it died. The Pioneer Creek female Spotted Owl left its home range on 20 May 2008, crossed the agricultural lands along the Chehalis River, and went to the Capitol State Forest. The move was more than 15 miles, highly unusual for an adult Spotted Owl. It remained in the Capitol State Forest until it was found dead on 26 August 2008.

In Table 1, we show the cumulative areas used by the radio-tagged owls, as estimated by MCP and Fixed Kernel algorithms. To date of this report, we have acquired sufficient

information to estimate cumulative home ranges for 10 Barred Owls that were tracked for at least 12 months. Their home ranges ranged from 466 acres (for the V-Line female tracked for 12 months) to 3,331 acres (Fall River male, tracked for 15 months), and averaged 1,418 acres as estimated using the 95% MCP method. Core areas, as estimated from a 50% fixed-kernel algorithm, ranged from 104-639 acres and averaged 355 acres.

We could not estimate a home range for the Elk Creek male Spotted Owl, although it traversed a larger area after it vacated its territory. We acquired 10 months of data from the Pioneer Creek female Spotted Owl (13 July 2007-23 May 2008), during which time we estimated its 95% MCP home range to be 2,331 acres. Interestingly, the area traversed by the Pioneer Creek Spotted Owl female during the subsequent 3 months during which it dispersed was over 11,000 acres (Table 1).

BARRED OWL FOOD HABITS

We collected regurgitated esophageal pellets from Barred Owls in areas near daytime roosting sites during the nesting season in 2009. We display a summary of items found in the pellets in Table 2, which includes some limited comparative information from 2 other locations (Arcata, CA and Klamath Falls, OR). Although the list for the two southern locations involves only 16 pellets, small mammals were most frequent by both weight and relative frequency. The major items seemed to include ground-dwelling and arboreal rodents such as woodrats, red tree voles and flying squirrels. By contrast, 62 pellets from Barred Owl in SW Washington contained a much wider variety of prey items, predominantly including Lagomorphs (snowshoe hare), 2 species of moles, and crayfish. We also found frogs and a screech owl among the Barred Owl prey items in pellets from SW Washington.

Table 1. Spotted and Barred Owls Radio-tagged in Southwestern Washington, 2007-08[a].

Bird ID Number	Months tracked	Site Name	No. Telemetry Locations	Home Range Sizes (ac) 95%MCP	90%FK	50%FK
		SPOW				
GF1	13	Pioneer Cr				
		Pioneer Cr—North	68	11913	1188	45
		Pioneer Cr—South	46	2331	2195	257
HM1	11	Elk Creek				
		Elk Cr—North	70	2588	1656	323
		Elk Cr—South	45	5343	4486	551
		BAOW				
AM1	15	Fall River	234	3331	2468	639
AM2	8	Fall River	55	1853	1310	235
BF1	6	Left Fork	41	375	595	158
BM1	17	Left Fork	224	1207	1587	550
CM1	3	Blue Mountain	33	542	1098	217
DM1	31	William's Creek	337	982	861	157
EM1	5	Right Fork	48	278	354	73
FM1	30	Seven Creek	307	814	944	241
IF1	12	V-Line	53	466	589	104
IM1	24	V-Line	290	1377	1480	463
JF1	6	Swem Creek	32	455	698	180
JM1	21	Swem Creek	306	1540	1639	394
KF1	7	T-Line	34	436	359	58
KM1	13	T-Line	168	573	748	122
LM1	18	Rock Creek	238	2334	2077	612
MF1	16	Dean Creek	214	1557	2130	268
NF1	1	Smith Creek	6	--	--	--
OF1	1	Lepac	4	--	--	--

[a]Identification: Letters were assigned sequentially with capture; M is for males, F is for females; final number represents 1st male or female marked at a location. STVA is an abbreviation for the Latin name of Barred Owls; STOC is an abbreviation for the Latin name of Spotted Owls. Totals as of 26 Jan 2010.

FUTURE ACTIVITIES

Intensive Spotted Owl surveys will continue by coordinating activities with cooperators. If new birds of either species are identified within the historical Spotted Owl sites, we will exert every means possible to capture and radio-tag them. Given that few or no Spotted Owls are expected to occupy the study area, however, we are obliged to emphasize Barred Owls. Our target of radio-tagging each member of 8-10 Barred Owl pairs has not been met; we have been successful in capturing both members of pairs at only 4 locations. Therefore, we plan to capture and radio-tag additional Barred Owls, emphasizing Pioneer Creek, Blue Mountain, Elk Creek, and Seven Creek. We will continue surveying for Barred Owls using Barred Owl calls to obtain better estimates of the number of pairs of Barred Owls in each of the 4 areas. Also, we have found it difficult to identify Barred Owl roost sites by "walking in" on transmitter signals, so that we might locate regurgitated pellets for subsequent food-habitat analyses. Barred Owls generally flush in advance of the fieldworkers. We anticipate collecting additional regurgitated pellets from Barred Owls by identifying their nesting areas, a method that has proved far more effective in another study in Oregon (Wiens et al. 2007). Readers should recognize that a nesting season sample does not necessarily represent diets on a year-round basis. We will also acquire forest-inventory data from the cooperators in preparation for detailed statistical analyses required for resource selection functions. It is possible that additional inventory may be required to complete the analyses for parts of the study area. Finally, we will analyze data that have been collected from triangulations of radio-transmitters randomly placed at geo-referenced locations (unknown to the recorder) to estimate accuracy of our telemetry system.

ACKNOWLEDGMENTS

We are very grateful for Weyerhaeuser Company and Washington Department of Natural Resources for funding as well as many efforts to facilitate this project safely and effectively. We thank the U.S. Fish and Wildlife Service and Washington Department of Wildlife for facilitating research permits. In particular, we are thankful for the efforts of Tony Melchiors, Kevin Godbout, Theodora Minkova, and Chris Montero. Tracy Fleming, Ralph Anderson, and Robert Pearson launched the field effort in 2007. We sincerely appreciate the field savvy provided by Laurie Clark, Karen Fawcett, and Melanie O'Hara, which improved acquisition of telemetry data. We owe a huge debt of gratitude to Christina Crabtree and Paul Leonard, who endured

with the aplomb of seasoned veterans the hardships of harsh weather, muddy- and snow-covered roads, and late-night and long hours of fieldwork. Rita Claremont conducted the dietary analysis of Barred Owl pellets.

LITERATURE CITED

Wiens, J. D., R.G. Anthony, E.D. Forsman, S.A. Graham, and M.R. Fuller. 2007. Competitive interactions between Northern Spotted Owls and Barred Owls in western Oregon: 2007 progress report. USDI and USGS Admin. Report. USGS, Reston, VA. 10pp.

Table 2. Items in esophageal pellets of Barred Owls in 3 study areas, 2009-10.

Species	Common Name	Age	Ave. Wt.	Freq	Rel Freq	% by Wt
ARCATA (N=9)						
Neotoma species	Wood rat	A	285 gr.	3	0.33	40
Lagomorph	Rabbit	A	500 gr.	1	0.11	23
Tamiasciurus douglasii	Douglas Squirrel	A	221 gr.	1	0.11	10
Arborimus pomo	Sonoma Tree Vole	A	26 gr.	8	0.89	10
Large Salamander		A	68 gr.	2	0.22	6
Glaucomys sabrinus	N. Flying Squirrel	A	130 gr.	1	0.11	6
Unknown mouse or vole		A	20 gr.	2	0.22	2
Medium Salamander		A	14 gr.	2	0.22	1
Peromyscus maniculatus	Deer Mouse	A	22 gr.	1	0.11	1
Neurotrichus gibbsii	shrew mole	A	9 gr.	1	0.11	trace
KLAMATH FALLS (N=7)						
Glaucomys sabrinus	N. Flying squirrel	A	130 gr.	6	0.87	95
Peromyscus maniculatus	Deer Mouse	A	22 gr.	1	0.14	2
Myodes gapperii	S. Red back vole	A	23 gr.	1	0.14	2
SW WASHINGTON (N=62)						
Lepus americanus	Snowshoe hare	J	500 gr.	6	0.1	28
Scapanus townsendii	Townsends mole	A	130 gr.	12	0.19	15
Scapanus orarius	Coast mole	A	56 gr.	29	0.47	15
Pacifastucas leniusuilus	Crayfish	A	100g est.	15	0.27	14
Tamiasciurus douglasii	Douglas squirrel	A	221 gr.	4	0.06	8
Glaucomys sabrinus	Flying squirrel	A	130 gr.	5	0.08	6
Neotoma cinerea	Bushy tailed woodrat	A	284 gr.	1	0.02	3
Tamias townsendii	Townsend chipmunk	A	83 gr.	2	0.03	2
Microtus townsendii	Townsend vole	A	54 gr.	4	0.06	2
Microtus oregoni	Creeping vole	A	20 gr.	8	0.13	1
Zapus trinotatus	Pacific jumping mouse	J	24 gr.	3	0.05	1
Medium frog		A	20 gr.	5	0.08	1
Megascops kennicottii	Screech owl	A	152gr	1	0.02	1
Unknown mouse or vole		A	20 gr.	7	0.11	1
Large frog		A	30 gr.	1	0.02	trace
Small frog		A	10 gr.	4	0.06	trace
Sorex bendirii	Pacific water shrew	A	18 gr.	1	0.02	trace
Small bird		A	10 gr.	1	0.02	trace

Sorex species		A	5 gr.	2	0.03	trace
Peromyscus maniculatus	Deer mouse	A	22 gr.	2	0.03	trace
Vole spp.	vole	A	30 gr.	1	0.02	trace
Neurotrichus gibbsii	shrew vole	J	9 gr.	3	0.05	trace
Unknown beetle		A	1 gr.	2	0.03	trace

LIST OF FIGURES

Figure 1

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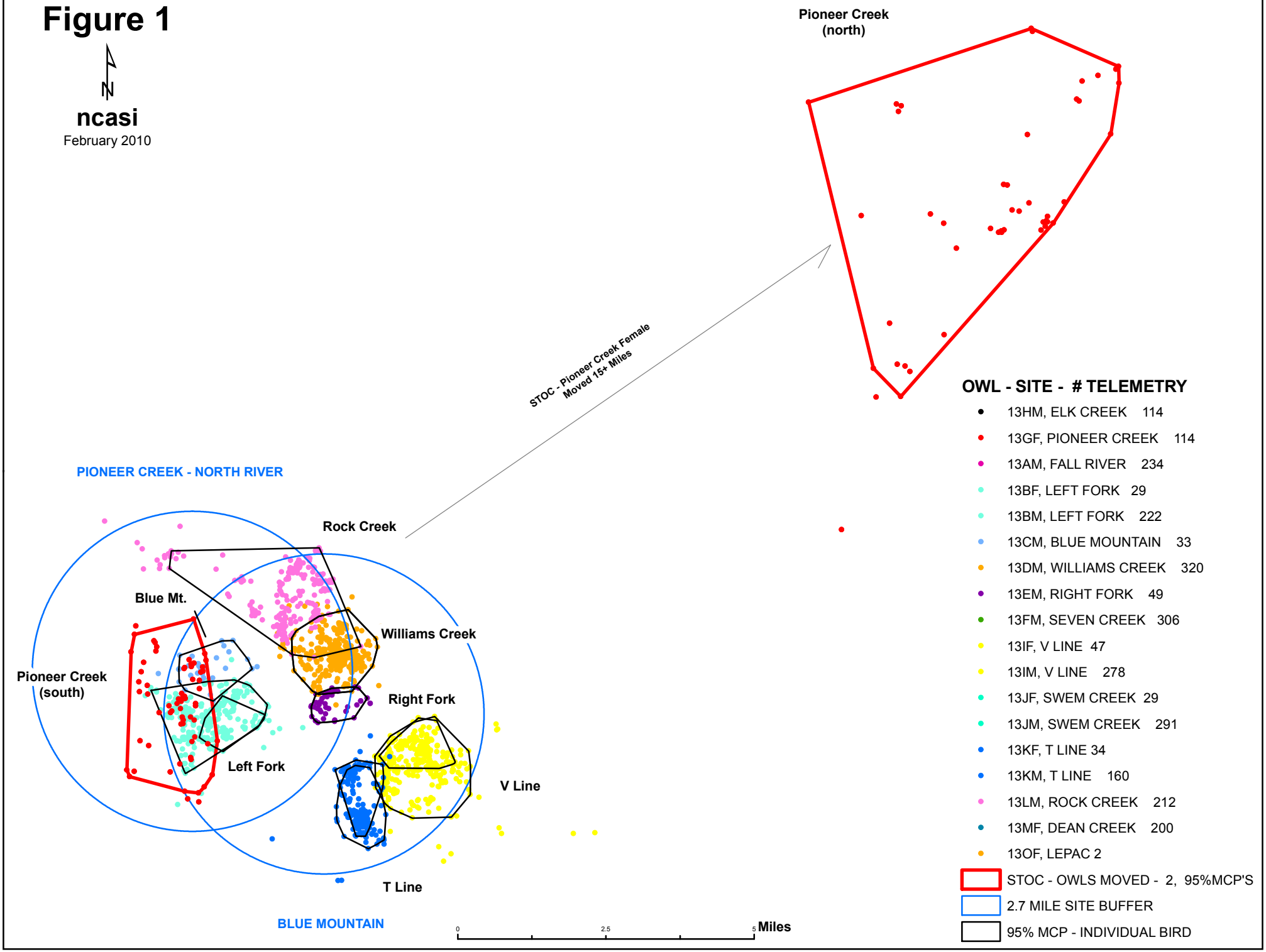

Figure 2

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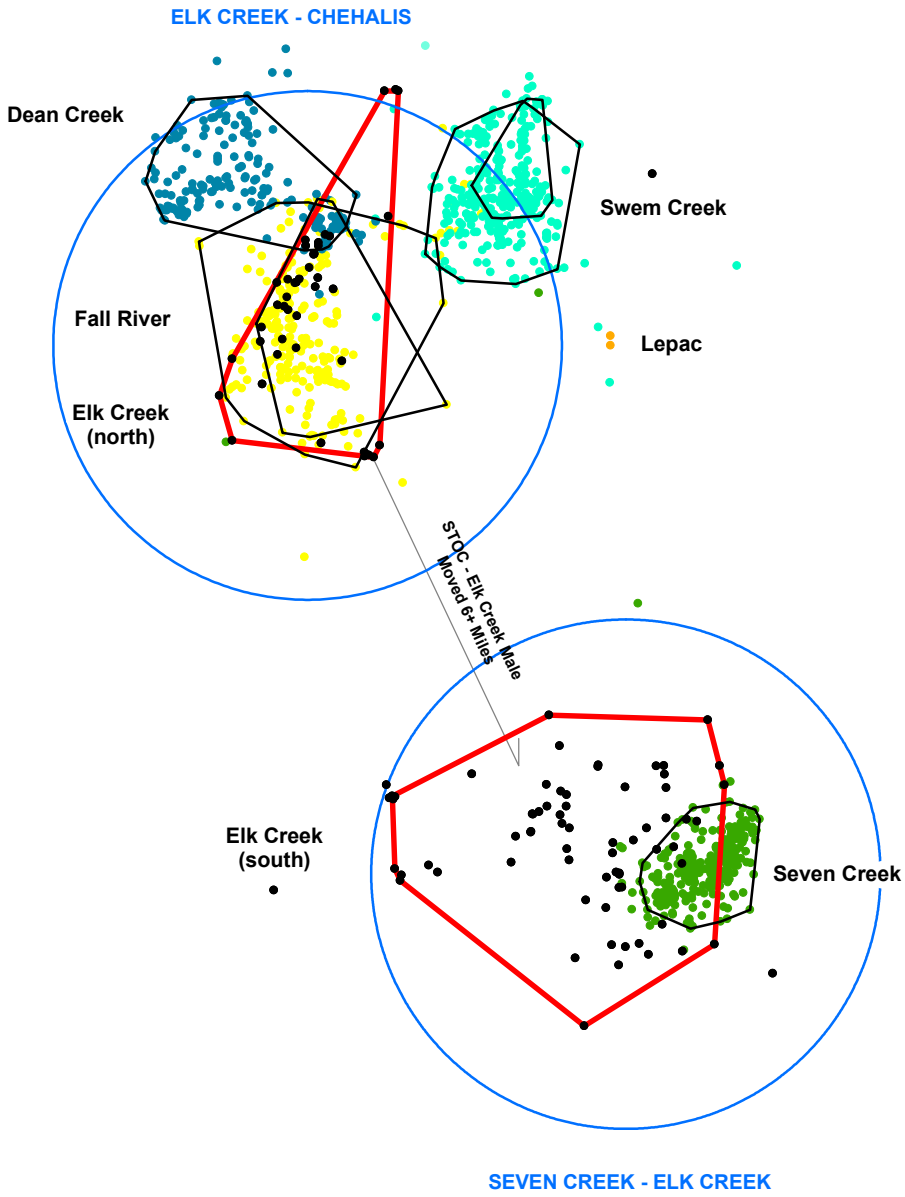

OWL - SITE - # TELEMETRY

- 13HM, ELK CREEK 114
- 13GF, PIONEER CREEK 114
- 13AM, FALL RIVER 234
- 13BF, LEFT FORK 29
- 13BM, LEFT FORK 222
- 13CM, BLUE MOUNTAIN 33
- 13DM, WILLIAMS CREEK 320
- 13EM, RIGHT FORK 49
- 13FM, SEVEN CREEK 306
- 13IF, V LINE 47
- 13IM, V LINE 278
- 13JF, SWEM CREEK 29
- 13JM, SWEM CREEK 291
- 13KF, T LINE 34
- 13KM, T LINE 160
- 13LM, ROCK CREEK 212
- 13MF, DEAN CREEK 200
- 13OF, LEPAC 2

STOC - OWLS MOVED - 2, 95%MCP'S

2.7 MILE SITE BUFFER

95% MCP - INDIVIDUAL BIRD